NETLAKE Guidelines for automated monitoring system development

006 Power supply options

Objective

In this factsheet, we describe some of the power supply options for your automated monitoring system (AMS).

Considerations

All AMS require some power to run. At their simplest, this may involve small, standalone sensors with ***internal batteries*** which can be downloaded e.g. at weekly or monthly intervals. Some standalone sensors will have batteries that can contain enough power to run for more than a year even if you measure your parameter at 10 minute frequency.

If you want more capability than standalone sensors, and you need to have a separate data logger then you need to think about power supply. For example, all multiparameter sondes require significant power to run for longer time periods. Some sondes can be powered with internal battery packs, but their capabilities will be in the range of weeks rather than months (depending on measurement frequency). Also some communication options (AMSD 08) can require significant power, especially if continuous communication is required.

Most AMSs will have external power supplies, capable of powering all the sensors, the data logger and the telecommunications. Some AMS have to have navigation lights, so that they are not a navigational hazard.

Solar panels which continuously charge the batteries on AMS are widely used at NETLAKE sites. The number and size of the ***external batteries*** and the charging capabilities of the solar panels will depend on how many sensors you want to run, what measurement frequency you want. Replacing discharged batteries may be needed in winter in northern latitudes. An often neglected drain on power is the telecommunications unit. A winch will also drain power quickly, as will certain sensors (e.g. CO_2 sensors). Careful consideration of the total power requirements will determine what power option is optimal.

How to simply calculate your AMS power consumption? To calculate your power consumption you need to know the amount of power your system uses and the amount of time the system is actively using that power. Most system components will have information on their power usage both when running and in some cases when in a resting stage.

To make these calculations you need to know a few basic computer formulas

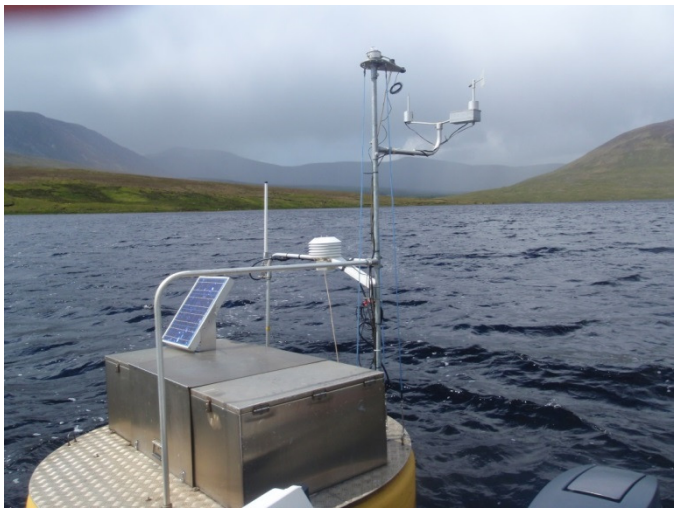
1. Power(watts) = Voltage(volts)*Current(amps)
2. Energy(watt hours) = Power(watts)*Time(hours)

Note that AMS systems often draw low currents in the mA ($A*10^{-3}$) range, so calculated power may be expressed in mW. Battery capacity is often given in amp hours (Ah). This can be converted to energy by multiplying by the battery voltage. A simple example could be a 12 volt winch motor that draws 20 watts when running. To calculate the time the system could be run with a 50 Ah battery one would make the following calculations.

- Time of use = 24 profiles/day * 0.25h/ profile = 6 hours running time / day
- Energy used = 20 watts * 6 hours = 120 watt hours
- Battery capacity used = 120 watt hours/12 volts = 10 Ah
- Running time = 50 Ah /10 Ah/day = 5 days

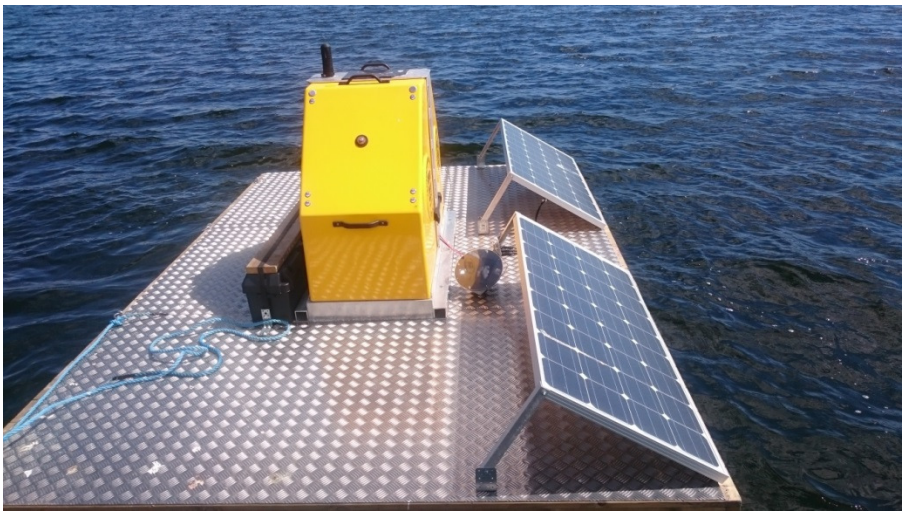
If you know the station is going to have a high power consumption, a ***cable*** may be more practical if you are within reach of the main supply. However, the efficiency of solar panels has increased while at the same time their price has decreased making them an attractive alternative even in situations of relatively high power consumption. When using solar panels similar power calculations must be made, balancing power usage against the power that can be obtained from the panels for different day lengths and assumed surface light conditions. In this case battery capacity is used to buffer the power obtained from the solar cells and that used by the system.

Examples



Feeagh: 6 X 12 volt 38 amp batteries, charged with one solar panel. This runs a multiparameter sonde, three standalone fluorometers, several meteorological sensors, a Campbell scientific data logger, and real time telecommunication via GPRS. Measurements are taken every two minutes.

Furnace: Same as for Feeagh, but as it has a winch doing four profiles a day, it has a second solar panel to supplement the charging power.



Erken: A YSI profiling system (18 Ah) winch uses two 150 watt solar panels, and a solar regulator that charge three 80 Ah AGM batteries. This provides more than sufficient power for the YSI system, even run long into the autumn when day lengths become much shorter in Sweden. There have been large increases in the effectiveness, and decreases in the costs of solar panels in recent years, so that systems such as the one described above are cost effective solutions to providing relatively large power needs.

Likely Problems

- You don't have enough power.
- The batteries run out before the intended deployment is over.
- The solar panels are not powerful enough.
- There isn't enough sunlight.
- The batteries do not have enough capacity.
- Something is draining power unexpectedly, perhaps because of a short circuit or a wiring issue.

More information

http://www.act-us.info/sensor_list.php?cat=Power%20Supply&type=Hardware

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